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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/712,326	11/12/2003	Rao Annapragada	LAM-P-1031	2008
48008	7590	05/10/2007	EXAMINER	
VIRTUAL LEGAL, P.C. MICHAEL A. KERR 3476 EXECUTIVE POINTE WAY, UNIT 16 CARSON CITY, NV 89706			NGUYEN, THANH T	
			ART UNIT	PAPER NUMBER
			2813	
			MAIL DATE	DELIVERY MODE
			05/10/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/712,326

Applicant(s)

ANNAPRAGADA ET AL.

Examiner

Thanh T. Nguyen

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 13 February 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Response to Arguments***

Applicant's arguments filed 2/13/07 have been fully considered but they are not persuasive.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-21 are stand rejected under 35 U.S.C. 102(e) as being anticipated by Chooi et al. (U.S. Patent No. 6,465,888) in view of Morrow et al. (U.S. Patent Publication No. 2002/0081854).

Referring to figures 2a-4f, Chooi et al. teaches a method of removing a photoresist layer (see col. 7, lines 59-60) from an integrated circuit (IC) structure with little or no etching of an exposed barrier layer comprising an integrated circuit (IC) structure having an etched dielectric layer with an exposed barrier layer, wherein the dielectric layer comprises silicon and oxygen (230, see col. 7, lines 47-54) and the barrier layer comprises silicon nitride or silicon carbide (215, see col. 7, lines 20-33), the method comprising:

Art Unit: 2813

Firstly, feeding a first gas mixture into a reactor wherein the first gas mixture comprises carbon monoxide (CO)(see col. 8, lines 17-33), after etching the dielectric layer (230) and exposing the barrier layer (215, see figure 2b);

Secondly, energizing the oxidizing gas mixture having carbon monoxide (CO) to generating a plasma in the reactor (see col. 8, lines 17-33, noted that gas have to flow in the chamber and plasmanizing); and

Selectively removing the photoresist layer with little or no etching of the exposed barrier layer (see figure 2b, col. 8, lines 11-16), thereby minimizing the loss of the exposed barrier material during removing the photoresist layer. Noted that since removing the photoresist by ashing without removing anything inside of the opening would minimize the loss of the barrier material.

Regarding to claim 2, dielectric material is silicon dioxide (230, see col. 7, lines 47-54).

Regarding to claim 3, the first gas mixture further comprises oxygen (O<sub>2</sub>) (see col. 8, lines 17-33).

Regarding to claim 4, the first gas mixture further comprises nitrogen (N<sub>2</sub>) (see col. 8, lines 17-33).

Regarding to claims 5, 11, 15, the first gas mixture further comprise the gas mixture selected from the group consisting of oxygen, nitrogen, nitrogen/oxygen, nitrous oxide, ammonia, nitrogen/hydrogen, and water vapor (see col. 8, lines 17-33).

Regarding to claims 6, 12, 17, etched dielectric material is composed of a material selected from the group consisting of silicon dioxide, silicon oxide, organosilicate glass, and fluorinate silicate glass (see col. 7, lines 34-54).

Art Unit: 2813

Regarding to claims 7, 13, 18, cap layer located between the dielectric and the photoresist, the cap layer is composed of a material selected from the group consisting of silicon dioxide, silicon oxynitride, silicon carbide and silicon nitride (235, silicon nitride, see col. 7, lines 54-58).

Regarding to claims 8, 14, reactor used to remove the photoresist from the IC structure is also used to etch the dielectric (see col. 8, lines 1-16).

Regarding to claim 9, 21, a third layer that includes a conductive interconnect (210) that abuts the barrier layer (215) and the second dielectric material (220) adjacent the conductive interconnect, the barrier (215) between the etched first dielectric layer (230) and the third layer (210).

Regarding to claims 10, 16, 19, 21, the first dielectric layer (230) and the second dielectric layer (220) is comprised of materials that include silicon and oxygen (see col. 7, lines 34-54, noted that silicon oxide includes silicon and oxygen).

Chooi et al. teaches etching the photoresist film by using carbon monoxide gas (CO) (see col. 8, lines 17-33). However, the reference does not teach removing the photoresist film from the surface of the structure by using carbon monoxide gas.

Morrow et al. teaches removing the photoresist film by using mixture of carbon monoxide gas (CO), oxygen and nitrogen gas from the surface of the structure (see figure 5e, paragraph# 54). Noted that the same gas would inherently provide the same function as minimizing the loss of the exposed barrier during the removal of the photoresist film.

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would removing the photoresist film by using carbon

Art Unit: 2813

monoxide gas (CO) from the surface of the structure in process of Chooi et al. as taught by Morrow et al. because removing the photoresist film by using mixture of carbon monoxide gas (CO), oxygen and nitrogen gas from the surface of the structure would prevent attack or damage to the bottom layer or the side wall of the structure.

### ***Response to Arguments***

Applicant's arguments filed 2/13/07 have been fully considered but they are not persuasive.

Applicant contends that Chooi et al. does not teach the use of an oxidizing gas mixture comprising carbon monoxide (CO) to remove the photoresist when the dielectric has been previously etched to expose the barrier layer. In response to applicant that Chooi et al. clearly teaches etching the dielectric layer (230) and exposing the barrier layer (215, see figure 2b) then feeding the oxidizing gas mixture of CO (see col. 8, lines 17-33) then removing the photoresist film with oxygen gas (see figure 2b, col. 8, lines 11-16). Chooi et al. also teach a method of etching the photoresist film by using CO (see col. 8, lines 17-33). However, Chooi et al. does not specifically teach removing the photoresist film by using CO. Examiner relies on Morrow to show the only feature that it is known in the semiconductor art to remove the photoresist film by using CO (see figure 5e, para# 54). Therefore, Chooi in view of Morrow do teach oxidizing gas mixture comprising carbon monoxide (CO) to remove the photoresist when the dielectric has been previously etched to expose the barrier layer.

Art Unit: 2813

Applicant also contends that Chooi et al. would etch the barrier during the removal of the photoresist layer by ashing because oxidizing gas mixture reacts with fluorinated polymer would etch the barrier layer. In response to applicant that Chooi et al. in col. 8, lines 11-16, teaches that removal of the photoresist layer includes one or more of the following: fluorocarbon, such as CF<sub>4</sub>, C<sub>4</sub>F<sub>8</sub>, hydrocarbon, fluorine-substituted hydrocarbons, fluorosulfur, chlorine, hydrogen bromide, oxygen, nitrogen, argon and carbon monoxide (see Chooi, col. 8, lines 3-7). This can be means that removal of the photoresist film can be used any single or combination of gases such as chlorine, hydrogen bromide, oxygen, nitrogen, argon and carbon monoxide wherein fluorocarbon, such as CF<sub>4</sub>, C<sub>4</sub>F<sub>8</sub>, hydrocarbon, fluorine-substituted hydrocarbons, fluorosulfur gas does not have to include during the removal of the photoresist film. Therefore, it would not remove the barrier film.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

Art Unit: 2813

however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (571) 273-8300.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (**See MPEP 203.08**).

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://paired.uspto.gov>. Should you have questions on access to thy Private PAIR system, contact the Electronic Business center (EBC) at 866-217-9197 (toll-free).



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